

**ON CENTRAL AUSTRALIAN MAMMALS**  
**PART II THE MURIDAE**

(Continued from 64, (1), 136, 1940)

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[Read 10 July 1941]

PLATES X, XI, XII, XIII

RATTUS spp.

No species of *Rattus* was taken in the area worked over, nor reliable reports of them obtained. However, the specimens of *R. villosissimus* described by Waite (15, 125) evidently came from a locality west of the Lake Eyre Basin,<sup>(1)</sup> and two slight anomalies in the skull measurements as compared with skulls from the latter district have already been pointed out.

The skulls have since been re-examined and the anomalies confirmed (in a reduced form). Both skulls have slightly longer molar rows, 7.5 and 7.4 as against a maximum of 7.3 in the Lake Eyre Basin, and the male skull has an interorbital breadth of 5.6 as against a maximum of 5.3. The latter skull is damaged and evidently old, and its temporal ridges are more like those of *norvegicus* than any other I have examined. In other dimensions and in non-metrical characters both are in good agreement with the eastern series.

PSEUDOMYS (PSEUDOMYS) MINNIE Troughton

This species, originally described from the Lake Eyre Basin, where it is periodically extremely abundant, was not taken in the Amadeus Basin, nor in any of the highlands adjacent to it, in the work of 1931-35; nor does it occur in any other collection from this region which I have examined. A small series, however, from the Arckaringa tablelands in the winter of 1933, about 60 miles south-west of Oodnadatta, has already been briefly noticed (3, 99).

The pelage in four is of the rich brown type common at Cordillo in 1930-31; the other two a paler grizzled buff phase approaching that of Mulka and Appamunna. Flesh dimensions of the four adults are slightly lower than the average for the Lake Eyre Basin series, but well within the extremes. The skulls are of the light and comparatively fragile type common in Appamunna collections, with both zygomatic breadth and width of brain case lower than in the larger series; they agree with these, however, in the three critical characters of molar length, anterior palatal foramina and palate length which separate *minnie* from *rawlinnae*.

The slight differences noted can have little significance as geographical variations, since specimens taken at Ooldea, 250 miles further to the south-west, are still closer to the Lake Eyre Basin average.

PSEUDOMYS (LEGGADINA) HERMANNSBURGENSIS Waite

Menki, of the Pitchenturra. Described (14, 405) in 1896 from material taken in and about the Macdonnell Ranges, subsequent work has proved its

<sup>(1)</sup> This term is used throughout these papers in the restricted sense defined by me in an earlier paper in Trans. Roy. Soc. S. Aust., 57, 195, 1933, and excludes the greater part of the western drainage towards the lake from the Finke, Stevenson, Hamilton, Alberga, and Arckaringa Creeks. In their upper course these streams traverse areas in which the mammals are scarcely differentiated from those of the Amadeus lands, while the eastern part of the Lake Eyre Basin is a well marked natural region, distinguished both by the absence of western forms and the presence of indigenous ones.

range to extend north to Alexandria (9, 536) in approximately  $19^{\circ}$  south and  $136^{\circ} 50'$  east; south to Ooldea (6, 318) in latitude  $30^{\circ} 27'$  south and longitude  $131^{\circ} 25'$  east; south-west to Rawlinna (13, 292), 400 miles west of Ooldea, and south-east (1, 10) to the junction of the Murray and Darling Rivers in north-west Victoria. It is absent from the Lake Eyre Basin, which is probably its eastern limit in the central areas, while to the west, in these latitudes, although no specimen has been examined from beyond Ayers Rock, it almost certainly extends to the Rawlinson Range on the Western Australian border and probably far beyond. It was not taken, however, by the Canning Stock Route expedition of 1930 through the Western Sandridge Desert.

Throughout the area between the Macdonnells and Everards, personally worked over during 1931-1935, it was widely spread but nowhere very plentiful, and on the loamy grass and mulga flats where most of the collections were made, it was out-numbered by *Notomys alexis*. It proved difficult to trap in the open country, with ordinary baits, largely because of the ants which swarm upon the traps in such areas. A few were got with bread baits in store tents at camps near the Basedow Range, where it had adopted the raiding habits of *Mus musculus*, which latter was often trapped alongside it.

The majority of the specimens were dug by the blacks from simple burrows two to three feet long and nine to twelve inches deep. Five was the greatest number taken from a tunnel, and on two occasions the gecko, *Nephurus laevis*, was found in occupation at the same time; the association is evidently well known to the blacks, as I had independent accounts of it from several localities. The natural diet seems to be entirely seeds, grass roots and small tubers; the chief constituent of the stomach contents in summer collections, particularly from the Basedow Range area, was a small dark-cased seed from the local succulent called Wokiti—a *Portulaca* species extremely abundant on flooded ground after summer rains. Sand was always present in variable, but sometimes very large amount.

The following examination is based upon 73 specimens, of which 22 are skins and skulls and the rest alcohol preserved. The series is made up of eight collections, taken at the following times and places.<sup>(2)</sup>

(1) At two camps between Wollara and the Basedow Ranges, February and March, 1932. (2) Ayers Rock, February, 1932. (3) Wollara, in winter of 1932. (4) Alpera, at the north-west extremity of the Musgrave Range, December, 1932. (5) Eriwunyawunya, Owellinna and Ernabella on the southern side of the Musgrave Range, January, 1933. (6) Chundrinna, on the northern front of the Everard Range, February, 1933. (7) Karmcena, on the southern side of the Everard Range, winter of 1915. (8) Miscellaneous specimens from Charlotte Waters, Hermannsburg, Macdonnell Ranges, Tennant's Creek, and three unlocalized.

The conclusions as to reproductive activity which can be deduced from these records are similar to those relating to *Notomys alexis*; i.e., seasonal independence of such activity and its occurrence in marked form after heavy rains. At Wollara, in February, 1932, six weeks after a heavy rain, reproduction was particularly active the collection comprising numerous growth stages from aged examples to nestlings. In this batch nearly all females are pregnant, and the frequency of litters is shown by the occurrence of heavily pregnant females still suckling nestlings. In adult males the testes are generally well developed and scrotal, or have undergone very recent retraction, leaving a prominent scrotal skin flap. Uterine embryos are either three or four, asymmetrically arranged with the larger number in the right horn. In the entire series sexed females predominate in the ratio 24 ♂ : 42 ♀.

<sup>(2)</sup> The bearings of these localities have been given in connection with *Notomys alexis* collections in Trans. Roy. Soc. S. Aust., 64, (1), 1940, 127.

A *Laelaps* occurs, but very sparsely; and in this respect the species is in strong contrast to *Notomys alexis*, which (at the same times and places) was heavily infested.

The great bulk of the material is clearly referable to the typical race, of which topotypes have been available, but in collections from the Musgraves, anomalous examples occur which fore-shadow racial differentiation; in the sequel the data relating to these has been disassociated from that of the main series, and will be considered under Section B.

#### A THE TYPICAL RACE

*External Characters*—Size, build and general appearance much as in *Mus musculus*, but the head larger and broader between the orbits when seen from above. Mystacial vibrissae to 32 mm.; moderately stout at base but the larger members terminating in an extremely attenuated almost invisible tip. Ear short and conspicuously broad; maximum length, 14.5.

The *manus* varies in size and proportions from individual to individual, and is sometimes widely different on the two sides of the same individual. Length from base of carpal pads to apex of third digit, to 6 mm. Breadth across the base of digits 2-5, 3 mm.; third digit to 3 mm. Undersurface of digits lightly haired; claws moderate and lightly fringed. Palmar pads generally well developed and high, their proportions moderately constant. Carpals, generally large and squat; outer much larger in area than inner, but not markedly elongate. Occasionally, especially in subadults, the carpals may be subequal and are then smaller than usual. The first and second interdigitals small and rounded or irregularly pyriform; the third subequal or larger than second, triangular with the apex distad and sometimes with an external accessory fold or heel, but never a separate satellite. General formula of the palmar pads therefore: outer carpal > inner carpal > third interdigital > or = second interdigital > first interdigital.

The *pes* has length to 18 mm.; breadth across base of digits 1-5, 3 mm. and across base of digits 2-4, 2.8 mm. Heel narrowed by infringement of hairs from both sides, and a few bristly hairs sometimes present in the main interdigital basin. Undersurface of toes lightly haired. Claws moderate, and moderately fringed. Plantar pads well raised; highly variable in size, shape and proportion. Metatarsals, small, round and subequal. First interdigital larger than metatarsals, but very variable, usually bluntly oval or rounded, sometimes divided into moities by a shallow vertical sulcus; second and third interdigitals generally pyriform and subequal; but in one or two examples  $2 > 3$  and bell-shaped; fourth interdigital obtusely oval or bell-shaped, normally much larger than two and three, but sometimes equal and occasionally with a postero-external heel or satellite. Immaturity chiefly shown by the smaller size of the interdigitals 1 and 4. The general formula of the plantar pads is, therefore: fourth interdigital > or = second = third > first > inner metatarsal = outer metatarsal.

*Tail* longer than the head and body except in one example, but variation as high as 25%; thin and tapering with the termination well haired. Scales on the mid-dorsum from 17 to 21 per cm. The posterior mammary nipples in functioning adults, 6 mm. from base of clitoris; the anterior 6 mm. from the posterior. The scrotum is pigmented almost black over the greater part of its area.

*Pelage*—The following description is drawn up from observation on living and recently chloroformed animals, supported by examination of field skins which have had no contact with liquid preservatives. Coat soft but sleek and not fluffy, texture varying somewhat with the proportion of guard hairs, which, however, are scarcely longer than the main pile; mid-dorsal length from 9 to 11 mm. On the dorsum, the basal two-thirds of all hairs is about blackish-plumbeous of

Ridgway, and the terminal one-third of the main pile varies from orange cinnamon in the brightest individuals to tawny olive in the duller. The longer guard hairs are black-tipped and the intermingling of these three colours, in varying proportions, produces a general external colour which varies from warm red browns near Mikado's brown to much colder and darker tones, near bistre. Mid-ventrally the fur is 5 mm. long, the basal one-third somewhat paler than the dorsal plumbeous, and the upper two-thirds snow white, completely excluding the basal grey. The sides show a more or less decided brightening in colour due to the usual falling off in the number of guard hairs and the line of demarcation from the white belly is very sharp. Head slightly greyer than the back but still strongly grizzled; the extremity of muzzle and upper lip greyish-white. The ears sparsely clothed within the upper margins only, with greyish-white; externally varying considerably from greyish-brown to blackish-brown. Fore and hind limbs internally like the belly, externally like the sides. Manus and pes dorsally pure white, with a slight calcaneal darkening in some examples. Tail distinctly bicolor, darker above, the colour varying like the ears from greyish-brown to blackish-brown. The scales are plainly visible mid-dorsally, but distally the hairs lengthen and are more closely set, forming at the tip a minute but distinct dark brush both above and below.

Seasonal and sexual differences nil—age variation appreciable but subject to much irregularity; in general, subadult pelages are slightly darker and colder than in adults. Short-coated nestlings are pure white ventrally, but at the head and body, 50 mm. stage, when the coat has lengthened, the basal colour ventrally may be either white or grey, but no examples of the retention of white-based belly fur in adults have been observed.

The effect of alcohol immersion upon the colouration of this species has been much less than upon *Notomys alexis* from the same areas, preserved under exactly the same conditions. After eight years the dorsal colour is still quite close to that of the field skins, though the white ventrum has been stained yellow.

*Skull and Dentition*—Twenty examined. Range in variation in non-metrical characters is wide with several anomalies in the relation of skull size to body size, and of skull size to molar wear, etc., though these are less than in *Notomys alexis* and *Pseudomys minnie*.

Nasals generally rather short and broad in subadults, longer and without addition to width in aged skulls; their contact with the frontals is fairly wide and the width increases but slightly to its maximum at the pre-maxillary margin.

Braincase remarkably variable in width and shape even in examples of the same basal length from the same locality, though the more conspicuously swollen examples are all aged skulls. The zygomatic outline shows similar and probably sympathetic variation from an almost parallel-sided condition to one in which the anterior width is little more than half the posterior. Age changes in the inter-orbital constriction slight or largely masked by individual variation; the mean value for subadult skulls little if at all greater than for adults. Upper and lower points of the zygomatic plate usually vertical or the lower somewhat anterior, with the free margin slightly concave or nearly straight, never *convex* as given by Thomas for the subgenus (11,604). In immature skulls the lowest point is decidedly anterior to the upper and the condition then quite similar to that in *Ps.* (*Gyomys*) *apodemoides*. Anterior palatal foramina comparatively wide, the posterior extension variable; sometimes falling short of the anterior margin of  $M^1$ , but usually reaching about one-third the distance from that point to the lingual cusp of the first lamina. Mesopterygoid fossa highly variable in size and shape; parapterygoid with distinct external and internal walls, neither feature

affording any appreciable distinction from such forms as *Ps. minnie*, *higginsii*, and *apodemoides*. Bullae large, swollen and subject to considerable age changes. In immature skulls the inflated portion rises almost abruptly from the hamular process, but in aged examples a low-set tubular portion separates the two. In the molars the antero-internal cusp of the upper  $M^1$  varies much in size, prominence and exact position; sometimes decidedly less lingual than as figured by Waite (14, pl. xxvi, 5d). It is, however, unmistakably present in all examples save one which is quite normal in other characteristics.

*Flesh Dimensions*—The following figures give, in mm., the range and mean value (in brackets) of: (1) adults selected as free from obvious immaturity in external characters; (2) subadults of slightly inferior bulk to Group 1; (3) a group definitely immature; and (4) two short-furred nestlings.

Even after minimising uncertainties as to maturity by segregation into several age groups and eliminating the geographical factor, the individual variation remains large within each group, reaching in some items as high as 25%. Moreover, the variation in any one dimension throughout the series, is complicated (as in *N. alexis* and *Ps. minnie*) by disharmonies in proportion in individuals—a maximum value for one dimension not infrequently occurring with a minimum value for another in the same example; this is particularly noticeable in the head and body: tail ratio. The tabular arrangement of four developmental stages brings out clearly the very early attainment of maximum dimensions of the pes, and to a less degree of the ear.

Waite's (14, 405) comparison of size of this species with *Mus musculus* is rather misleading; it should be stressed that *hermannsburgensis* is quite equal to the former in average bulk, and the four conventional measurements of the two species overlap so widely, that distinction by this means is impossible.

*Skull Dimensions*—the following figures give in mms. the range and mean (in brackets) for 6 ♂ and 7 ♀ skulls, extracted from examples of the series free from obvious immaturity in flesh characters and showing wear on all laminae of  $M^1$ , followed by the values for a subadult ♀ having H. & B. 69 mm., weighing 8.5 grammes, and with unworn molars.

	(1)		(2)		(3)		(4)	
	8 ♂	19 ♀	5 ♂	7 ♀	2 ♂	3 ♀	♀	♀
Tail	74-90 (81.5);	73-97 (84)	72-78	72-86 (74);	70-72 (71);	67-72 (72)	65	41
Head and Body	71-79 (74);	70-83 (75)	65-70	66-71 (67);	58-60 (59);	55-58 (57)	46	47
Pes	17-17.5 (17);	16.5-18 (17.5)	16.5-18	16-18 (17);	17-17	16-17.5 (17)	16	14
Ear: length	13-14 (13.5);	13-14.5 (14)	13-14.5	13-14 (14);	12.5-12.5 (12.5);	12-12 (12)	12	9
Ear: breadth	7-10 (7.5);	6-10 (8)						
Rhinarium to Eye	9.5-11 (10);	9-11 (10)						
Eye to Ear	9-10 (9);	9-10 (9.5)						
Weight (in grammes)	9.5-14.5 (12);	8-18.5 <sup>(3)</sup> (12)						

<sup>(3)</sup> This maximum is from a female with four full-term embryos; excluding twosuch, the maximum is reduced to 14 and the mean to 11.

Greatest length	-	-	-	-	21.6-23.2 (22.1), 21.0-23.2 (22.1); 20.6
Basal length	-	-	-	-	17.0-19.5 (17.9), 17.6-19.2 (18.4); 16.8
Zygomatic breadth	-	-	-	-	10.7-11.8 (11.2), 10.7-12.2 (11.1); 11.4
Braincase breadth	-	-	-	-	10.4-11.5 (10.9), 10.5-11.8 (10.8); 10.8
Interorbital breadth	-	-	-	-	3.3-3.8 (3.5), 3.3-3.7 (3.5); 3.5
Nasals, length	-	-	-	-	7.4-8.2 (7.7), 7.2-7.9 (7.6); 6.4
Nasals, greatest breadth	-	-	-	-	2.0-2.5 (2.4), 2.1-2.6 (2.3); 2.3
Palatal length	-	-	-	-	10.5-11.7 (11.1), 10.4-11.5 (11.1); 10.7
Ant. Palatal Foramina; length	-	-	-	-	3.8-4.6 (4.3), 4.0-4.5 (4.3); 3.8
Ant. Palatal Foramina; breadth	-	-	-	-	1.4-1.6 (1.5), 1.4-1.7 (1.6); 1.4
Bullae	-	-	-	-	4.3-4.7 (4.5), 4.4-5.0 (4.8); 4.7
Upper Molars	-	-	-	-	3.4-3.9 (3.6), 3.4-3.8 (3.6); 3.5

B Ps. (LEGGADINA) HERMANNSBURGENSIS cf. var. BOLAMI Troughton

Four specimens from the Musgrave Range are conspicuous in possessing a very long pes associated with a very long ear. The three adults (all ♀) have the following range of dimensions: head and body 70-78, tail 81-92, pes 18-19, ear 15.5-17, and suggest affinity with the form from Ooldea, named as above by Troughton (13, 292). Brazenor (1, 10) has disputed the racial validity of this form on the grounds that local variation, both in Ooldea and in Central Australian material, is sufficiently high to embrace the dimensions given for both races, and that the pelage characters quoted for the southern form can be found much further north in specimens of normal dimensions, and the data given by Wood Jones for his Ooldea series certainly supports him so far as dimensions go. No specimens from Ooldea are available to me, but I find, on careful analysis of all relevant characters of the present series, that despite intergradation of individual characters, and a high prevailing rate of variation, the four specimens noted are easily distinguished from the rest by: (1) simultaneous occurrence of maxima for pes and ear; (2) larger size of the metatarsal pads and a more posterior site for the inner of the two, in the two specimens in which this can be tested; (3) the presence of all three of these features in a very immature example, which has head and body 66, tail 77, pes 19, ear 16.5. In pelage characters two of them are conspicuously cold in colour; the others quite normal.

This complex of characters makes an approach to *bolami*, as given by Troughton, and would appear to justify the view that two distinct strains of *hermannsburgensis* occur side by side throughout the area between Ooldea and the Musgrave Range. The absence of pure communities of *bolami* at Ooldea might well be due to the interdiffusion having taken place on an east-west, rather than a north-south axis, in which case its centre of origin may lie far to the west in the area from which unfortunately no specimens are available.

It should be noted that the skull of the long-eared, long-footed example from the Musgrave Ranges, here examined, differs in no way from that of its associates. Of the three skull characters quoted for *bolami* at Ooldea, the interorbital width and molar length are both to be found in numerous short-eared, short-footed examples of the typical race, from the localities listed above.

PSEUDOMYS (LEGGADINA) WAITEI Troughton (13, 290)

Twelve specimens examined; one adult, one subadult, and three nestlings from Wollara in the winter of 1932; one adult and three nestlings from Macdonald Downs in the winter of 1933; one subadult and two extra skulls unlocalized, but probably from the Macdonnell Ranges.

The Wollara specimens were obtained by a group of natives from the Petermann Range, who regarded it as a rarity and called it Anoola. Unlike *hermannsburgensis*

which greatly out-numbers it at Wollara, it makes no considerable burrow but lives and nests in shallow excavations at the base of *Triodia* tussocks.

The adult female of this batch was lactating and the three associated nestlings were probably hers; the subadult female was pregnant with three embryos, two in the right horn of the uterus, one in the left; the Macdonald Downs female was also lactating and associated with three nestlings. Of the nine which can be sexed, seven are females. Stomach contents in the Wollara examples consisted of coarsely granular reddish vegetable matter and some sand.

*External Characters*—Head and body length about as in the largest examples of *hermannsburgensis*, but the body bulkier, thicker set, with stronger limbs, Head much as in the latter species; the ear length to 14 mm.; mystacial vibrissae to 30 mm.

*Manus* large and heavy; length from base of carpal pad to apex of middle digit 7.5; breadth across base of digits 2-5, 3.5 mm.; third digit to 3 mm.; claws of moderate length and well fringed. Pads of medium size but sharp cut and high; outer carpal longer than inner but the disproportion in area less than in *hermannsburgensis*, and the third interdigital rounded and not triangular. Pad formula: outer carpal > inner carpal > second interdigital > third interdigital > first interdigital.

*Pes*—Short, broad and strong; length to 17.5 mm.; breadth across base of digits 1-5 to 3.8 mm.; middle toe to 4 mm. Pads strongly developed and high, and notable for their simple, rounded and complete outlines, without trace of heels or satellites. Somewhat variable, but in the two best preserved examples the metatarsals and first interdigital are small, round and subequal, and the second, third and fourth interdigitals larger, rounded not pyriform, and also subequal, leading to the unusual formula: fourth interdigital = third = second > first = outer metatarsal = inner metatarsal.

*Tail* conspicuously short, ranging from 65-77% of the head and body length; scales, 27 per cm.

In the largest lactating example the posterior mammary nipple is 9 mm. from clitoris; the anterior 11 mm. from posterior.

*Pelage*—No field-made skins are available, and the following description is drawn up from material preserved in alcohol for eight years. Fur moderately soft in texture, guard hairs scarcely coarser than the main pile; fluffier and more sparse than in *hermannsburgensis*. Mid-dorsally the main pile reaches 9 mm. and guard hairs 11 mm.; basal two-thirds of the former coloured a medium plumbeous; followed by a subterminal band of dull ashy buff and free tips black; guard hairs black throughout. General external dorsal colour near Ridgway's buffy brown; paler, less brown and more distinctly grizzled than in *hermannsburgensis*. Ventrums creamy white to base (probably pure white in nature). Sides clearing somewhat but still ticked with black almost to the junction with the ventrum, where a narrow band of pale buff intervenes; transition much less sudden than in *hermannsburgensis* and somewhat less than in *forresti* of the Lake Eyre Basin. Head like the back. Ears pale in substance; within sparsely haired greyish-white towards margins; externally pale ashy buff, darkening to the anterior margin, where there is a narrow border of blackish-brown. Limbs externally like the sides, internally like the belly. Manus and pes originally white or very slightly greyed, and the latter with a small area of buffy-brown on the external aspect of the ankle. Tail well covered with moderately erect hairs, which do not lengthen towards the tip to form a brush; bicolor, the dorsum buffy over a small area near the base, then greyish-brown to end; below greyish-white.

The northern specimens from Macdonald Downs are somewhat more olivaceous than those from Wollara but the detailed distribution of colour is quite the same. The six nestlings are all at the dark short-coated stage, but are all more buffy dorsally than *hermannsburgensis* nestlings of comparable growth, and the ear shows distinctly the narrow dark mark on the anterior margin.

*Skull and Dentition*—Two examined, both ♀; one from Wollara, one from Macdonald Downs; they are in close agreement with one another and with the example figured by Waite (14, pl. xxv, fig. 1 *g-h*). General features apparently very close to the form of *forresti* from the Lake Eyre Basin, of which, however, only parts of one skull are available. Skull larger than that of *hermannsburgensis* in almost all dimensions, but braincase, nasals, interorbital breadth and the bullae relatively smaller than in fully adult examples of that species. In dorsal aspect the zygomata are stronger anteriorly and wider spread in their middle course, and the braincase is more abruptly expanded, resulting in a squarer outline, as mentioned by Waite. Interorbital area strongly concave and supraorbital edges levelled off in a characteristic way by a marked muscular impression and not rounded and overhanging as in *hermannsburgensis*. Temporal and occipital muscular impressions more pronounced and in the larger of the two skulls, the former are distinctly beaded, though less so than in Waite's figure. The zygomatic plate has its upper and lower points on a perpendicular and the free margin distinctly concave in its lower course, not convex, and its completed outline a shallow sigmoid. Anterior palatine foramina narrower, especially posteriorly, where they extend almost to the lingual cusp of the first lamina.<sup>(4)</sup> Upper M<sup>1</sup> much larger, its length exceeding the combined lengths of M<sup>2</sup> and M<sup>3</sup>. A very large elongate antero-internal cingular cusp is present on the upper M<sup>1</sup>; it is much larger and its position more apical than in *hermannsburgensis*. Incisors long; markedly orthodont.

*Flesh Dimensions*—Dimensions in mms. of (1) an adult ♀ from Wollara, (2) an adult ♀ from Macdonald Downs, (3) a subadult ♀ from Wollara. Head and body, 88, 83, 79. Tail, 59, 64, 52. Pes, 17, 17.5, 16; breadth (across base of digits 1-5), 3.5, 3.8, —. Manus length, 7.5, 7.5, 7; breadth, 3, 3.5, 3. Ear, 12.5, 14, 12.5.

As shown by Waite's table and confirmed by the present material, individual variation is considerable. The dimensions of the topotype, as re-measured by Troughton, can be exactly matched in the Wollara specimens, but it should be noted that the values for head and body, tail and pes, in the type are all considerably exceeded, both in Waite's series and in the present specimens.

*Skull Dimensions*—Dimensions of the two above females from Wollara and Macdonald Downs, respectively; both have worn molars. Greatest length, 24.1, 25.4; basal length, 21.3, 22.6; post. zygomatic breadth, 13.3, 14.0; braincase breadth, 12.0, 11.7; interorbital breadth, 3.5, 3.6; nasals length, 8.2, 8.2; nasals breadth, 2.3, 2.3; palatal length, 12.5, 14.0; ant. palatal foramina length, 5.3, 5.5; ditto, breadth, 1.3, 1.5; bullae, 4.6, 4.6; upper molar row, 4.2, 4.5.

The Wollara specimens undoubtedly represent the typical race as defined from Alice Springs, and the agreement of the Macdonald Downs specimen is also close in essentials. It is noteworthy, however, that this specimen, like that of Troughton from the Hart Range, 50 miles south, shows minor anomalies in a longer ear and probably in colouration as well, and may foreshadow a still more marked differentiation further to the north-east. From *forresti* (3, 101), of the Lake Eyre Basin (to which it is much closer than to *hermannsburgensis*), it is distinguished by its darker colouration, longer and softer fur, bicolor tail, longer nasals, and, in the southern part of its range at least, by its shorter ear.

<sup>(4)</sup> Waite's figure is erroneous here, as pointed out by Troughton (13, 290).



## LAOMYS PEDUNCULATUS Waite 1896

Neither specimens nor recognisable accounts of this interesting rat could be obtained during 1931-5. A special sojourn was made at Illamurta on the south side of the James Range in the hope of obtaining it, but the place is less virgin than when E. C. Cowle got his two specimens there, and trapping was without result.

In working out the relationships of the succeeding species, I have re-examined seven examples; five alcohol preserved and two skulls. Three of these are of the original series upon which Waite (14, pl. xxv, fig. 1 *a-f*) founded *pedunculatus*, and the others are evidently of the second collection noted by him two years later (15, 117). All are from Alice Springs in the central Macdonnells, except one skull representing the variety *brachyotis* which is from Illamurta.

None of the males show any external vestige of a scrotum; in two females the mammary nipples are moderately prominent, but neither uteri are pregnant. The stomachs of the five in alcohol have all been skilfully extracted through a small incision in the lateral abdominal wall—probably by natives, as I have seen a similar embalming trick practiced by their children upon lizards. The sex ratio in the combined series recorded is 8 ♂ : 3 ♀.

The following notes are supplementary to Waite's generally excellent description, and may serve to bring the account of this interesting species into uniformity with those dealt with in this series of papers.

*External Characters*—Four of the alcohol specimens are evidently adult and are uniform in bulk and dimensions; the fifth is slightly smaller and apparently subadult. Form rather stout and short-limbed, an appearance heightened by the profuse pelage and swollen tail. Head large and long muzzled with a well-developed though not swollen upper lip and moderately prominent rhinarium. Ears large and broad. Eye apparently prominent in life. Mystacial vibrissae strongly developed, stout basally and the longer members reaching 65 mm.; smaller anterior members white, the rest black with the terminal one-quarter white. The general aspect of the head in these specimens is not especially anomalous, very much as in the larger *Pseudomys* spp.

*Manus* stout, with conspicuously short digits and small though prominent pads. Length to 11 mm.; breadth across the base of digits 2-5, 5 mm.; middle digit, 4 mm. Backs of digits strongly haired and the short, weak claws well fringed. Palm and undersurface of digits quite naked. Outer carpal considerably exceeding inner both in length and area, and the inner faintly heeled. Interdigitals much smaller than carpals, rounded or roughly heart-shaped, and the third always with a distinct satellite postero-laterad; their relative size somewhat variable, but in the majority: outer carpal > inner > third interdigital > second > or = first. Pes very stout and tapering strongly to heel. Length to 27.5 mm.; breadth at base of digits 1-5; 6.5 mm.; middle digit to 5.5 mm. Pads, except for lower metatarsal, short, rounded, but well raised. The lower metatarsal with a variable and low posterior prolongation and a somewhat crescentic or comma shape. The upper metatarsal much smaller and rounded; first and fourth interdigitals equal, bell-shaped or rounded, with the base heeled, especially in the fourth, where it is almost a separate satellite pad in some examples. Interdigitals, second and third bluntly pyriform, subequal, or the second the larger. Formula of pedal pads, therefore: inner metatarsal > fourth interdigital = first > second = third > outer metatarsal.

Tail slightly longer than head and body, as high as 114%. Detailed shape as given by Waite, and much as in *Chaetocercus cristicauda*; incrustation variable, reaching a maximum diameter of 12 mm.; scales ventrally about 12 per cm. Integument over the swollen portion thick and fibrous but not fragile; below the

derma the tail tissues are of normal diameter and apparently devoid of fat (in alcoholic material).

Posterior mammary nipple 6 mm. from base of clitoris, anterior 8 mm. from posterior.

*Pelage*—Rather harsh but quite profuse; mid-dorsally the main pile averages 18 mm. with guard hairs up to 25 mm., but a proportion of them are co-terminous with the main pile; ventral fur 10 mm. Distribution of colour, in the main as given by Waite, but in the unfaded examples there is a marked increase in the richness of the ground colour upon the crown and nape and tail base (clay colour to cinnamon), and the resulting external colour varies from tawny olive on these parts to Saccardos umber on the mid-back. The external colour over the whole of the ventrum is creamy white; basally it is pale plumbeous on thorax and mid-belly, pure white on gular, sternal and inguinal areas. The dark markings on the originally buffy manus and pes are still plain in four of the five specimens. The tail brush reaches 15 mm. beyond tail tip.

*Skull*—The two skulls examined are those used by Waite, and of these his excellent figures are apparently based upon the larger, the measurements of which are given below. The *brachyotis* skull is definitely young and with less worn molars, but does not differ in any important way; its incisors have been destroyed. In general structural characters the skull of *Laomys pedunculatus* is quite similar to that of *Leporillus* (as pointed out by Thomas (10, 372)), and is still closer to the larger species of *Pseudomys* s.str., such as *higginsii*. The striking molar characters of parallelism of laminae and reduction of buccal cusps are shown in about the same degree by both skulls; in the larger the incisors are stout and strongly opisthodont.

*Flesh Dimensions*—The following are the results of the re-measurement of (1) two adult ♀ and (2) two adult ♂, from Alice Springs: Head and body, 137, 124; 120, 119. Tail, —, 128; 130, 126. Pes length, 27, 27.5; 27, 27; breadth at base of digits 2.5, 6.5, 6.5, 6.5, 6. Manus length, 11, 10; 11, 11; breadth at base of digits 2.5, 5.5, 5.0; 5.0, 5.0. Ear, 23, 22; 23, 20. Rhinarium to eye, 20, 19; 20, 19. Eye to ear, 12, 11; 13, 11.

*Skull Dimensions*—Re-measurement of the skulls "F" and "B" studied by Waite gives the following figures. "F" represents *brachyotis* from Illamurta. Greatest length, 35.0, 36.8; basal length, 28.9, 31.1; zygomatic breadth, 17.0, 17.6; braincase breadth, 15.6, 16.0; interorbital breadth, 5.0, 5.2; nasals, length, 12.6; 13.3; nasals, greatest breadth, 3.5, 3.8; palatal length, 18.1, 19.3; anterior palatal foramina, length, 7.0, 7.3; ditto, breadth, 1.9, 2.1; bulla, 5.1, 5.3; upper molar series, 6.6, 6.5.

In his key to the genera of South Australian Muridae, Wood Jones (6, 296) makes use of the incrassation of the tail as a differential generic character. In the five examined there is marked variation in this feature and Waite mentions that the form *brachyotis* is less incrassated, as is also, apparently, the later species *woodwardi* of Thomas. While the dermal thickening is perhaps less subject to change than the fat deposits of thick tailed marsupials, it seems nevertheless an uncertain character to use in such a connection. The ear length of *Laomys*, also used in this key, is inferior to that of *Ps. minnie* and *Ps. fauritus*.

#### PSEUDOMYS (THIETOMYS) NANUS Gould

*Mus nanus* Gould, 1857, P.Z.S. 243; Waite, 1897, Proc. Roy. Soc. Vic., N.S., 10, 127, pl. vi, fig. 4 a-d

*Mastacomys* sp., Waite, 1896, Rpts. Horn Expd., II, 406, pl. xxvi, fig. d-f; *ibid*, 1897, Proc. Roy. Soc. Vic. N.S., 10, 128

*Rattus* or *Pseudomys* sp., Thomas, 1922, A.M.N.H., 10, (9), 550

*Pseudomys (Thetomys) nanus*, Wood Jones, 1925 (in part), Mamm. S. Aust., 314-315

*Pseudomys (Gyomys) desertor* Troughton, 1932, Rec. Aust. Mus., 18, (6), 293

*Gyomys desertor*, Iredale and Troughton, 1934, Check List Aust. Mamm., 79

*Pseudomys (Gyomys) desertor*, Brazenor, 1936, Mem. Melb. Mus., 10, 74

Seven specimens examined; two skins and skulls, three in alcohol and two skulls without skins. Of these, two were obtained in January 1933, about 10 miles south of Koonapandi on the southern front of the Musgrave Range, in an area of sandy loam covered by giant spinifex, which was being worked at the time for the Maala (*L. hirsutus*). One specimen was dug by a native boy from a shallow hole, and the other I trapped some days later with a witchetty larva bait set for *Chactocercus cristicaudata* which was plentiful in the vicinity. Of the others, one is from near Mount Crombie in the same area as the above, two more are of the Horn Expedition material from the localities in and north of the Macdonnell Ranges, listed by Waite, and two are unlocalised but are probably also from the Macdonnell Range area.

Little data is available on reproduction or habits. Of the six which can be sexed, three are ♀, three ♂. All but one are adult or advanced subadults. Two of the males have prominent testes in conspicuously dark pigmented scrota. Stomach contents were not examined, but the modification of manus and the success of the larva bait on traps, suggests that the diet may be partly insectivorous.

It is a species of strikingly distinctive characters. The Pitchenturra name is Entroota.

*External Characters*—Form in fully adult examples stout, short-limbed, powerful. The head with short pointed muzzle and bowed profile. Eye and ear small; the latter to 14.5 mm, with a breadth of 9.5 mm, across the trough of the pinna; rounded in outline and thick in substance; relatively shorter than recorded for any *Gyomys*. Mystacial vibrissae weak, the longest ca. 25 mm.

*Manus*—Details of manus and pes are based chiefly upon a subadult example in alcohol (figured) in which these features are well preserved; but the condition in adults is evidently very similar though the parts are stouter and the digits less attenuated.

Length from base of carpal pads to apex of third digit 7 mm.; width across base of digits 2-5, 3 mm.; middle digit 4 mm. Claws remarkably long, slender, sharp, and strongly curved even in the oldest examples. Undersurface of digits naked and strongly ridged; palms dusky. Pads small but fairly high and well developed; carpals plain, the outer slightly larger both in area and length than the inner; first interdigital small, rounded; second pyriform, third crudely triangular, and with a distinct heel or satellite postero-externally. Outer carpal > inner > second interdigital = third > first.

The modification of the manus, in the great length of the central digits and their claws, suggests a specialization to a probing and piercing function, though this is somewhat discounted by a similar if less extreme condition in the pes.

*Pes*—Tapering to the heel from an interdigital breadth of 4 mm.; third digit 5 mm. Undersurface of toes as in manus; claws sharp and long, but less so than in the manus. Plantar surface irregularly pigmented and mottled, and the pads made conspicuous by still darker pigmentation. Pads small and weakly developed; metatarsals and lateral interdigitals bell-shaped with apex distad; second and third interdigitals elongate pyriform; fourth with a low satellite; fourth interdigital = inner metatarsal > third interdigital = second > outer metatarsal

> first interdigital. Tail shorter than head and body; its length from 88 to 93% of same; mid-dorsal scales 14-15 per cm.

*Pelage*—The following description is drawn up from field notes upon chloroformed animals, and upon a field-made skin, having had no contact with preservatives.

Fur harsh, coat dense. Mid-dorsally the main pile is about 11 mm. long, the guard hairs 18 mm. The colour of the basal half is blackish-plumbeous, the broad subterminal band about clay colour, and the extreme tip of about 1 mm. black. The guard hairs are black throughout or have the extreme tip pale buff, and the resulting external colour is a strongly grizzled rich brown near Saccados umber, but the exact colour, as in all strongly grizzled pelages, depends on the angle of view. The dorsum of head grizzled like the back, but the ground colour both here and on the rump slightly richer than mid-dorsally. Ear, both within and without, well covered with cinnamon buff hairs; externally the buff is mixed with a sprinkling of blackish-brown especially towards the anterior margin, but there is no localized dark marking on the margin. Eye conspicuously ringed with an area of rich cinnamon. Sides somewhat paler than the back but still strongly grizzled; the transition to the belly gradual. The basal colour on the ventrum for the most part paler than on the back; the external colour at the margins of the belly similar to the sides—a lightly grizzled cinnamon buff with the slate basal colour showing through, but in the centre of the belly there is an irregular-shaped area of bright unmixed cinnamon buff; remainder of ventral surface greyish buff with the basal colour showing through. Limbs externally like the sides; internally like the margins of the belly. Carpus and manus cinnamon buff with irregular markings of blackish-brown covering a large part of both; digits greyish-white. Pes, generally cinnamon buff but a dark blackish-brown marking on the outer aspect of tarsus; digits of pes changing sharply to greyish-white, then to black at the base of the claws. Tail well haired throughout and forming an incipient brush terminally; the basal 5 mm. a rich cinnamon on all surfaces; the rest strongly bicolor, with the dorsal hair jet black and ventral, cinnamon buff fading distally into greyish-white.

Seasonal and sexual variation apparently nil, but individual variation appreciable though not great. The orbital ring which is a very conspicuous marking in the living animal, is present in all the specimens, as are also the dark markings on manus and pes. However, in one subadult example in alcohol, the curious midventral chestnut patch is absent, and in another (skinned from alcohol) the chestnut areas of ear and tail base are grizzled with black.

*Skull*—Five examined, including specimens C and E figured by Waite. In general aspect and many details of structure and dentition, very unlike the skulls of *Gyomys* available to me. It is strongly, even massively, built and densely ossified, and in general outline and form of braincase and nasals reminiscent of *Mus* and *Rattus*, respectively. The braincase is tapered anteriorly, not globular, and the interorbital space in adults is narrow and tubular, but not bevelled at the edges. The nasals peculiarly shaped, with a bulbous expansion anteriorly, from which they narrow rapidly posteriorly, terminating well in advance of the main labyrinth of the fronto-maxillary suture. The nasals and muzzle short and broad, and in profile strongly arched down. Lacrymals moderately large and rounded. Zygomatic outline strongly tapered forward, the anterior width only half the posterior; the individual zygomata stout and strong. In the zygomatic plate the upper and lower extremities are vertically situated and the edge evenly concave in two, nearly straight in two others, and terminates above a well-marked masseteric tubercle. Anterior palatal foramina short and narrow, barely reaching the molars, their maximum width anterior to their mid-point. Parapterygoid fossa well developed and deep, with a well-marked external wall, in the only adult

(figured) in which this region is undamaged, shallower in immature skulls. Bullae large, broad and much inflated. Upper molars heavy and broad, with the laminae of  $M^1$  and  $M^2$  feebly cusped and but slightly arched; in worn examples (as figured), the laminae are almost transverse as in *Laomys*. A variable but sometimes well-marked cingulum extends around the posterior and lingual margins as far as the first lamina, where (in the example figured) a distinct low level cusp is developed. This is absent in the other four, where, however, rugosities are sometimes developed on the same site. In the lower molars the supplementary posterior cusp is present but very reduced. Incisors short, stout and opisthodont.

*Flesh Dimensions*—The following figures give the dimensions in mm. of (1) an adult ♂ from Koonapandi, (2) an adult ♀ from Mount Crombie, and (3) an adult ♂ unlocalized but probably from the Macdonnell Range. Head and body, 101, 98, 107; tail, 88, 92, 97; pes, 21.5, 21, 21.5; ear, 14 x 9.5, 14.5, 13 ca.; rhinarium to eye, 14, —, —; eye to ear, 12, —, —; weight in grammes, 28.5, —, —.

*Skull Dimensions*—The following are the skull dimensions in mm. of (1) the above ♂ from Koonapandi, (2) the above ♀ from Mount Crombie, (3) the ♀ skull "E" figured by Waite. Greatest length, 26.6, 27.5, 25.9; basal length, 23.0, 23.6, 21.8; zygomatic breadth, post., 14.3, 14.2, 14.0; braincase breadth, 13.4, 12.9, 12.9; interorbital breadth, 3.4, 3.5, 3.6; nasals length, 9.2, 9.0, 9.1; nasals breadth, 2.6, 2.8, 2.5; palate length, 14.1, 13.9, 13.9; anterior palatal foramina, length, 4.4, 4.6, 4.4; ditto, breadth, 1.4, 1.4, 1.3; bulla, 5.5, 5.6, 5.4; upper molar row, 4.7, 5.0, 4.9.

The material here reviewed undoubtedly represents the species from Central Australia identified by Waite as *Mus nanus* Gould and re-named *Pseudomys* (*Gyomys*) *desertor* by Troughton in 1932 on the grounds of subgeneric unconformity with *Thetomys*, in which group Thomas had meantime (1910) placed Gould's *nanus*. I am unable at present to follow Troughton in this, however, both through doubt as to the unconformity with *Thetomys* and belief in its unconformity with *Gyomys*.

Under the first head, the following points may be noted: (1) Gould's plate of *nanus* illustrates the living Central Australian animal closely both in general aspect and detail; the discrepancies that exist might reasonably be attributed to omissions by the artist; the description and dimensions are also in agreement. (2) Thomas, in 1910 and in subsequent contributions, did not dispute Waite's identification of the adult Central Australian specimens, though the immature *were* questioned. (3) No description, dimensions, or figures of the skull of *nanus* appear to have been published, but Thomas's definition of the *Thetomys* skull (with *nanus* as genotype) agrees with the present material in the majority of points raised; particularly in the more normal (*i.e.*, *Rattus* or *Mus* like) form of skull, in the frequent concavity of the zygomatic plate and the deeper excavation of the parapterygoid fossa.

The evidence of the supplementary cusp on  $M^1$  seems to me much less conclusive of affinity here than is believed. Thomas omits any mention of the number of skulls examined, and in view of the varying incidence of the cusp already shown in *Notomys*, *Pseudomys*, and even *Leggadina*, this doubt must continue until series are examined. It may be recalled that a cingular cusp does occur on one of the five skulls here examined, and that in the two examples of *Thetomys gouldi* which have been figured, it is quite absent from that of Waterhouse.

There is little evidence of regional variation. Specimens here noted are from localities about 300 miles south-west of the most southerly of Waite's series, but the agreement in all characters is close. Some minor differences in dimensions are evidently due to condition of material or method of observation; for example, the very short ear given by Waite is no doubt due to the older method of measur-

ing the back of the pinna, and in the holotype of *desertor* (a mounted specimen) to shrinkage. No really large specimens (judged by externals) seem to have been examined hitherto, though the above holotype skull is as large as any of the present five.

Brazenor has recorded an interesting extension of the range of this species, to the Murray River in north-west Victoria, nearly 1,000 miles from the Central Australian sites.

#### LEPORILLUS APICALIS Gould 1853

Though the types of the species described by Gould were said to be from South Australia, its position in the fauna of the southern portions of this State remains very obscure, as records and material alike are entirely lacking. That the original specimens were from northern mallee or Upper Murray districts and not from the far north or centre is rendered very probable, partly by the circumstance that these latter were at that time for the most part unknown, and partly from the records of its plentiful occurrence ten years later in the contiguous Victorian mallee, provided by Krefft (7, 64) and Brazenor (2, 77).

The first reference to the presence of *Leporillus* in Central Australia (exclusive of the Lake Eyre Basin) is provided by Ernest Giles, who, in the summer of 1872-73 near Mount Peculiar in the north-west Macdonnells, records having seen nests of "*Mus conditor*" in a dense mixed mulga scrub. The nests were 15-20 feet in diameter and 4 feet high and contained sticks, up to 3½ feet long and 1 inch in diameter (4, 101). A month or two later, having crossed the Amadeus Basin, he again records the presence of these stick nests along the 26° parallel between Ayers Range and the Cavanagh Range. It was not till 23 years later that specimens obtained by Mr. Field at Alice Springs enabled Waite (15, 115) to identify the species as *apicalis*. In 1903, Basedow recorded a nest-building rat as occurring plentifully near his camp 68, south of the Mann Range.

Recent interrogation of blacks by Mr. Bowman at Glen Helen in the western Macdonnells indicates that it may still be extant in the country west of Mount Peculiar along the north border of the Aboriginal Reserve, and the Pintubis hercabouts call it Tweecalpi, and the west Aruntas Turulpa. But over the greater part of the country traversed by Giles between the Macdonnells and the 26° parallel and as far west as the West Australian border, it now seems to have become rare to vanishing point, and though the blacks are well acquainted with it still and give consistent descriptions of it, I failed to secure specimens on any of the routes personally travelled during 1931-35. Several white residents, however, particularly A. Brumby of Ernabella, who had travelled much along the southern part of the Mann and Tomkinson, assured me that some of the colonies mentioned by Basedow and Giles south of the Mann and Musgrave, were still extant, and in the winter of 1933 while conducting Dr. Cecil Hackett and Mr. N. B. Tindale through the area, he found a nest under a kurrajong on limestone country eight miles west of Mount Crombie. From this two specimens were secured by the time-honoured method of firing the pile and allowing the natives' dogs to seize the inmates as they fled.

As pointed out in discussing the disappearance of *L. conditor* from the Lake Eyre Basin, the usual explanation given by settlers of the disturbing effect of introducing stock into the rats' habitat, is quite insufficient to account for the facts. In the western centre the argument fails altogether, since the chief known former habitats of *apicalis* have never been stocked. On the other hand, a sparse but active hunting aboriginal population persisted here much later than in the Lake Eyre Basin, and the stubbornly colonial and gregarious habits of the rats render them very vulnerable to the attack by fire; there seems little doubt that the native has been the chief factor in their disappearance.

All specimens of *Leporillus* from the western centre so far examined have proved to be *apicalis*, and the most westerly record for *conditor* in these latitudes is the west shore of Lake Eyre, 450 miles east-south-east of the locus of the specimens here described. It is quite possible, however, that formerly both species occurred in the central areas; overlapping of their former habitats in Victoria and New South Wales seems well attested.

Both Mount Crombie specimens were adult non-pregnant females, with mammary nipples strongly contracted. The stomach contents were voluminous but little characteristic; for the most part finely comminuted as in such small species as *Notomys alexis* and quite without recognisable vegetable fragments or sand. The rich oily seeds of the local kurrajong (*Brachychiton Gregorii*) no doubt contribute to the diet. The dung pellets are short and obtusely oval; the largest about 7 x 5 mm. No external parasites were taken upon the preserved material.

*External Characters*—The only alcohol preserved material of other species available for comparison is the series bred in captivity from Lake Eyre Basin stock which I have already reviewed (3, 111). Compared with these, the present form is light and slender limbed. Head relatively longer and narrower muzzled and profile straight. On preservation the head has "set" upon the vertebral column almost at right angles and the ears are pricked, faithfully reproducing the characteristic "alert" stance apparently adopted by all the species. Ear apparently of much the same relative size as in *conditor*; longer than in *jonesi*; mystacial vibrissae strongly developed, as stout as in the much larger *conditor* and much longer; to 83 mm.; black with a long attenuated white tip.

*Manus*—Length to 16 mm.; breadth to 6.5; third digit to 6.5. Pads relatively smaller than in *conditor* of the Lake Eyre Basin and their shape more angular and puckered, though this may be due to plasmolysis. Outer carpal larger than inner, both in length and area; first and third interdigitals crudely triangular and both with heels or satellites; second crudely tetrahedral. Outer carpal > inner > second interdigital > third = first.

*Pes*—Much lighter than in *conditor* of the Lake Eyre Basin and with pads simpler, especially the lateral interdigitals which are less hollowed out at the base; differing in detail on the two sides of the same specimen. The inner metatarsal on the right side crescent-shaped with the concavity laterad; on the left side much straighter though of the same overall length. The outer metatarsal much smaller, evenly oval; second and third interdigitals irregularly oval, first and fourth with well marked postero-laterad heels and their completed outline bell-shaped. Fourth interdigital > second = third > first > inner metatarsal > outer metatarsal.

*Tail* decidedly longer than the head and body (1:1.2); rather thinly haired anteriorly; scales showing through plainly, 10 per cm.

Mammary nipples very posterior and close together; posterior 9 mm. from base of clitoris; anterior 9 mm. from posterior.

*Pelage*—In dealing with the colouration of the Alice Springs material, Waite limited himself to a reference to Gould's plate (5, pl. ii, 3), with which he found agreement. Brazenor (2) does not mention the preservation of his material nor its location, and Troughton's notes (12, 32) are based on old faded mounted specimens. The following description is drawn up from the skin of the larger of the Mount Crombie specimens made up after six weeks in alcohol, and it shows minor discrepancies with each of the foregoing, the importance of which it is difficult to assess at present.

Fur comparatively soft and dense and of even texture; the two constituent piles differing in length and colour, but not greatly in the thickness of the hairs.

Mid-dorsally the shorter is 18 mm. long, with its basal two-thirds dark plumbeous followed by a subterminal band of warm buff, and the extremity dark brownish black. The second pile reaches 23 mm. (though a proportion is scarcely longer than the first) and is similarly plumbeous at the basal two-thirds and the rest shining black. The resulting external colour from crown to tail base is a strongly grizzled brown near Prout's Brown, the general effect browner and less yellow than in *conditor*, and still more so than in *jonesi*. On the sides the subterminal colour fades to ivory and the black overlay is reduced, leading to a much paler and greyer grizzle. Belly fur 14 mm.; creamy white to base; junction with sides sharp. Dorsum of head like back or with a slightly richer ground colour; muzzle and cheeks like the sides with a rather conspicuous paler patch infraorbitally. Chin and throat like belly. Ears very sparsely covered within with greyish-white, externally well and evenly haired with a fine grizzle of near black and silvery-grey darkening only very slightly at the anterior margin; the ear back as a whole near fuscous and much colder and darker and more contrasted with the crown than in either *conditor* or *jonesi*. Outer aspect of fore limb like sides but with a wash of pale buff sharply interrupted by a narrow oblique grizzled black marking extending quite across the carpus; manus and digits white. Hind limb similar but with a browner wash; a grizzled black marking extending irregularly right round the tarsus, but not produced along sides of pes, which is quite white. Tail sparsely haired proximally, but lengthening distally and culminating in a pure white pencil extending 25 mm. beyond the terminal vertebra. Dorsum of tail blackish-brown for three-quarters of its length, changing abruptly to white without intermingling; lateral and ventral surfaces white throughout.

*Skull and Dentition*—Two skulls have been examined; the larger of the Mann Range specimens and one from Alice Springs figured by Waite. The former is considerably more aged, and is narrower, has narrower anterior palatal foramina and lighter molars, but the agreement in diagnostic features is close. The general structural characters of the *apicalis* skull are close to those of *jonesi* and *conditor*, the slight but apparently valid differences being a narrower braincase and posterior zygomatic width, narrower lacrymals, deeper muzzle, a nearly vertical and straight zygomatic plate, and anterior palatine foramina which are slightly longer than the molar rows. The lengths of molars and nasals are also lower than have been recorded for other species, and the bullae are smaller. The interorbital condition is not appreciably different. Waite's reference to horn coloured molars is evidently meant to apply to incisors. His (15, pl. v, fig. 1 a-c) figure does not agree very well with the skull on which it is based; the outlines of nasals and zygomata are appreciably different and the bullae are less globular.

*Flesh Dimensions*—The following are the dimensions of the two Mount Crombie specimens, both adult ♀: head and body, 184, 175; tail, 217, 238; pes length, 43, 44; pes, breadth across base of digits 1-5, 9, —; manus, 16, —; manus, breadth across base of digits 2-5, 6.5, —; ear, 33, 32; rhinarium to eye, 21, 22; eye to ear, 16, 15.

*Skull Dimensions*—The following are the dimensions of the skull from Alice Springs figured by Waite (re-measured), and that of the larger Mount Crombie ♀: greatest length, 40.5, 43.2; basal length, 35.1, 36.2; zygomatic breadth, 20.4, 20.1; braincase, breadth, 17.4, 17.9; interorbital width, 5.1, 5.2; nasals, length, 15.5, 15.4; nasals, breadth, 4.5, 4.6; palatal length, 21.3, 21.8; ant. palatal foramina, length, 8.0, 8.0; ditto, breadth, 3.3, 3.0; bullae, 7.1, 6.8; upper molar series, 7.5, 7.7.

While easily distinguished from *conditor* and *jonesi* by its much longer and pencilled tail, by its pure white belly fur and somewhat lighter build, all three species are evidently very closely allied; one of the above specimens is larger than



has previously been recorded and still further closes the gap in dimensions between the species; attention may be drawn to the misprint in Brazenor's dimensions. The specimens here described show certain minor discrepancies with existing accounts, which are difficult to interpret owing to the widely different condition of the material on which they have been founded. As compared with Gould's plate of the types, the Mount Crombie examples are more grizzled dorsally, their ear backs and tail tops are definitely darker and the tail much better brushed. The colouration is definitely darker and more grizzled than the specimens of *conditor* and *jonesi* available to me, and not lighter as given by Troughton (*loc. cit.*), and the dorsal colour is browner than the tawny olive given by Brazenor.

Brazenor (*loc. cit.*), who alone seems to have examined both central and south-eastern specimens, considers them identical.

#### HYDROMYS CHIRYSGASTER Geoffrey

No specimens of this rat could be obtained, and so far as numerous enquiries show, it is unknown in the western centre by settlers and natives alike. Songer's (8, 9) record, quoted by B. Spencer, applies to the Lake Eyre Basin where the prevailing form has south-eastern affinities, as I have elsewhere shown (3, 114).

#### INTRODUCED SPECIES

Of exotic murids, *Mus musculus* seems to be the only representative. It was common, though much less so than in the Lake Eyre Basin and its numbers have never yet, I think, assumed plague proportions in the western centre. Those taken were nearly all of the dark-bellied greyish, urban types and were probably recent intruders. Several examples examined had entirely unnotched incisors as in *Pseudomys*, and rapid distinction from the duller examples of *Ps. hermannsburgensis* was not always easy.

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## EXPLANATION OF PLATES

## PLATE X

A: Right pes of *Pseudomys (Leggadina) hermannsburgensis* cf. var. *bolami*. Imm. ♀. Erliwunyawunya. Musgrave Ranges. x 4.0. B: Right pes of *Ps. (Leggadina) hermannsburgensis typicus*. Adult ♂. Ayers Rock. x 4.0. C: Right pes of *Ps. (Leggadina) waitei*. Adult ♀. Wollara. x 4.0. D: Right pes of *Ps. (Thetomys) nanus*. Subadult ♀. Koonapandi. x 3.3. E: Right pes of *Laomys pedunculatus*. Adult ♀. Alice Springs. x 2.5. F: Right pes of *Leporillus apicalis*. Adult ♀. Mount Crombie. x 1.7. G: Right manus of *Ps. (Leggadina) hermannsburgensis typicus*. Adult ♀. Ernabella. Musgrave Range. x 5.7. H: Right manus of *Ps. (Leggadina) waitei*. Adult ♀. McDonald Downs. x 4.8. I: Right manus of *Ps. (Thetomys) nanus*. Subadult ♀. Koonapandi. x 5.5. J: Right manus of *Laomys pedunculatus*. Adult ♀. Alice Springs. x 3.0. K: Left manus of *Leporillus apicalis*. Adult ♀. Mount Crombie. x 2.3.

## PLATE XI

A and B: Dorsal aspects of skulls of an aged and adult female, respectively, of *Ps. (Leggadina) hermannsburgensis typicus*, both from Wollara; to show the extremes of variation in braincase development and zygomatic outline. x 3.2 and 3.4. C: Dorsal aspect of skull of *Ps. (Thetomys) nanus*. Adult ♂. Koonapandi. x 2.8. D: Lateral aspect of right manus of same. Subadult ♀. Koonapandi. x 11 ca. (The digits are artificially flexed for purposes of illustration.) E: Palatal aspect of B. x 3.4. F: Palatal aspect of C. x 2.7.

## PLATE XII

A: Dorsal aspect of skull of *Ps. (Leggadina) waitei*. Adult ♀. Wollara. x 2.9. B: Dorsal aspect of skull of *Laomys pedunculatus*. Adult ♂. Alice Springs. x 1.9. C: Dorsal aspect of skull of *Leporillus apicalis*. Adult ♀. Mount Crombie. x 1.6. D: Palatal aspect of A. x 2.9. E: Palatal aspect of B. x 1.9. F: Palatal aspect of C. x 1.6.

## PLATE XIII

A: Lateral aspect of skull of *Leporillus apicalis*. Adult ♀. Mount Crombie. x 1.6. B: Lateral aspect of skull of *Laomys pedunculatus*. Adult ♂. Alice Springs. x 1.9. C: Lateral aspect of skull of *Ps. (Leggadina) waitei*. Adult ♀. Wollara. x 2.9. D: Lateral aspect of skull of *Ps. (Leggadina) hermannsburgensis typicus*. Adult ♀. Wollara. x 3.4. E: Lateral aspect of *Ps. (Thetomys) nanus*. Adult ♂. Koonapandi. x 2.8. F: Right molars of same. Adult ♂. Koonapandi. x 8.2. G: Right molars of *Laomys pedunculatus*. Adult ♂. Alice Springs. x 5.7. H: Right molars of *Ps. (Leggadina) waitei*. Adult ♀. Wollara. x 10.0. I: Right manus of *Ps. (Leggadina) hermannsburgensis typicus*. Subadult. x 10.5.